

Rhizoctonia root rot resistance of *Beta* PIs from the USDA-ARS NPGS, 2005.

Twenty-eight plant introductions (PI) from the USDA-ARS National Plant Germplasm System (NPGS) (including garden beet, sugar beet, leaf beet, fodder beet, and wild beet) were evaluated for resistance to *Rhizoctonia* root rot. The trial was a randomized complete-block design with five replications. One-row plots (56 cm row spacing) 4 m long were planted at the ARS Fort Collins Research Farm, CO, on 25 May. The field had been summer fallowed in 2004 and planted to barley in 2003. The soil (Garrett loam, 0 to 1 % slope, pH 7.8) was deep ripped and plowed in early Apr, 2005, disked, roller harrowed and landplane-leveled prior to bedding and planting. Seed was planted to moisture, and furrow irrigated as needed. Inoculation with dry, ground, barley grain inoculum of *Rhizoctonia solani* isolate R-9 (AG-2-2) was performed on 28 Jul at a rate of 25 g/m row with inoculum applied on the crown of the plant. Immediately after inoculation, plots were cultivated (using an in-row duck-foot cultivator) to place soil onto the plant crowns. The plant population was thinned to 20-25 cm spacing by hand. Beets were harvested 19 Sep, with a single row lifter (pulled and cleaned by hand) and each root was rated for rot on a scale of 0 (no damage) to 7 (dead plant with root completely rotted). The avg disease severity was determined to create a disease index for each PI. Analyses of variance (PROC ANOVA) were performed on disease indices (DI), % healthy roots (classes 0 and 1 combined) and % roots in classes 0 through 3 (harvestable roots). Data in classes 0-1 and 0-3 were transformed using arcsine square root to normalize the data for analyses (AP 0-1 and AP 0-3, respectively). Both percentages and transformations are shown below.

The PI were tested in a disease nursery that included 11 additional tests, involving experimental breeding material and commercial cultivated varieties. Controls were included in all 12 tests. *Rhizoctonia* root rot reached moderate severity levels in early Sep for the entire nursery. The avg DI across all 12 tests in the 2005 nursery for highly resistant FC705-1, resistant FC703, and highly susceptible FC901/C817 controls were 2.7, 3.1, and 4.9, respectively. Percentages of healthy roots (those in disease classes 0 to 1) were 27.6, 25.4, and 6.4% for these controls, respectively. The percentages of harvestable roots (those in disease classes 0 through 3) were 59.1, 56.7, and 18.3% for these controls, respectively. The greatest and least DI for all of the lines evaluated in the nursery, including materials not in the PI tests, were 7.0 and 1.5, respectively.

For the PI reported below, differences in the DI among entries were significant ($P < 0.001$). Three PIs (#504220, #504223 and #546403) had DI that were not significantly different from either the resistant or the highly resistant controls (#991017 and #831083 respectively). PI #504220 for AP 0-1 (healthy roots) and PI#504223 for AP 0-3 (harvestable roots) were significantly less diseased than the susceptible check (#941025).

Seed Source	Subspecies	Donor's ID	DI*	% 0-1	% 0-3	AP 0-1	AP 0-3
PI 504182	<i>maritima</i>	Wild beet, Italy.....	6.0	0.0	20.8	0.0	20.0
PI 504183	<i>maritima</i>	Wild beet, Italy.....	6.5	2.0	8.4	3.7	10.9
PI 504184	<i>maritima</i>	Wild beet, Italy.....	6.4	0.0	10.6	0.0	12.3
PI 504190	<i>maritima</i>	Wild beet, Italy.....	5.8	9.5	18.0	12.8	20.9
PI 504193	<i>maritima</i>	Wild beet, Italy.....	5.7	2.8	15.2	4.4	15.2
PI 504199	<i>maritima</i>	Wild beet, Italy.....	6.2	0.0	12.4	0.0	18.3
PI 504202	<i>maritima</i>	Wild beet, Italy.....	6.7	0.0	0.0	0.0	0.0
PI 504206	<i>maritima</i>	Wild beet, Italy.....	7.0	0.0	0.0	0.0	0.0
PI 504223	<i>maritima</i>	Wild beet, Italy.....	4.0	35.7	55.0	31.4	53.1
PI 504235	<i>maritima</i>	Wild beet, Italy.....	7.0	0.0	0.0	0.0	0.0
PI 504237	<i>maritima</i>	Wild beet, Italy.....	6.3	0.0	0.0	0.0	0.0
PI 504238	<i>maritima</i>	Wild beet, Italy.....	nr**				
PI 504239	<i>maritima</i>	Wild beet, Italy.....	5.3	0.0	29.2	0.0	29.2
Ames 4436	<i>maritima</i>	Wild beet, Italy.....	4.8	11.0	28.0	13.8	28.2
PI 504248	<i>maritima</i>	Wild beet, Italy.....	5.5	4.0	14.0	5.3	14.3
PI 504253	<i>maritima</i>	Wild beet, Italy.....	5.8	11.6	11.6	13.0	13.0
PI 504264	<i>maritima</i>	IDBBNR 5798, UK.....	6.6	0.0	5.8	0.0	6.5
PI 518304	<i>maritima</i>	IDBBNR 5814, UK.....	5.9	5.0	17.5	6.6	17.9
PI 518320	<i>maritima</i>	IDBBNR 5836, UK.....	5.5	9.5	18.3	12.4	24.8
PI 518342	<i>maritima</i>	IDBBNR 5927, UK.....	5.5	6.6	23.0	7.0	24.7
PI 518433	<i>maritima</i>	WB 817, France.....	6.0	5.0	9.6	6.0	11.7
PI 540566	<i>maritima</i>	WB 886, France.....	nr**				
PI 540632	<i>maritima</i>	IDBBNR 5600, UK.....	4.5	25.0	34.5	22.5	32.0
PI 546403	<i>maritima</i>	IDBBNR 5637, UK.....	4.2	17.0	42.0	17.7	40.2
PI 546407	<i>maritima</i>	IDBBNR 5644, Greece.....	5.3	12.8	23.6	13.4	27.9
PI 546428	<i>maritima</i>	IDBBNR 3863, Ireland.....	6.8	0.0	5.6	0.0	8.8
PI 604031	<i>maritima</i>	IDBBNR 9685, Greece, Aegean.....	6.1	3.6	15.6	7.0	20.0
PI 546518	<i>maritima</i>	IDBBNR 9675, Greece.....	6.6	2.8	7.2	4.4	10.0
PI 546508	<i>maritima</i>	Wild beet, Italy.....	5.4	12.5	25.0	11.3	22.5
PI 504220	<i>maritima</i>	4.1	42.3	47.3	40.1	46.7
941025	<i>vulgaris</i>	(FC901/C817)//413 - 'Susceptible Check.....	4.3	12.4	24.2	18.1	25.7
831083	<i>vulgaris</i>	FC705/1 - 'Highly Resistant Check.....	2.8	51.4	58.0	45.8	52.9
991017	<i>vulgaris</i>	FC703 - 'Resistant Check.....	2.7	36.4	66.2	36.5	57.8
		LSD (P=0.05).....	1.4			17.1	24.5
		Trial Mean.....	5.5	10.1	20.1	10.6	21.5

* DI = Disease index on a scale of 0 (no damage) to 7 (plant death), % 0-1 = % roots in class 0 and 1 combined, % 0-3 = % roots in class 0 to 3 combined, AP is the arcsine-square root transformation of percentages of roots in classes 0-1 and 0-3 to normalize the data for analyses.

**nr = not rated. Two lines had very poor emergence. All analyses were performed without these two lines.